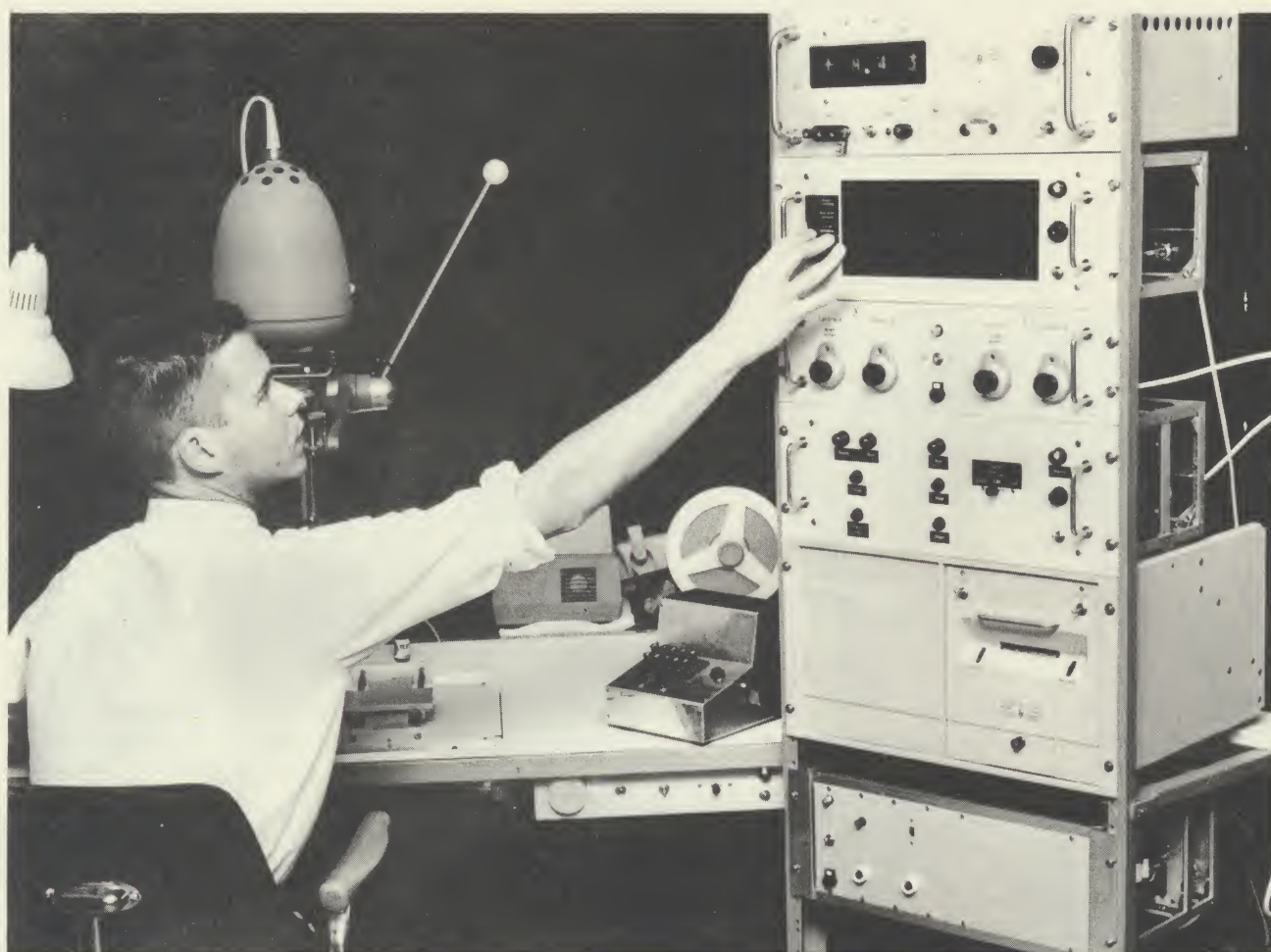


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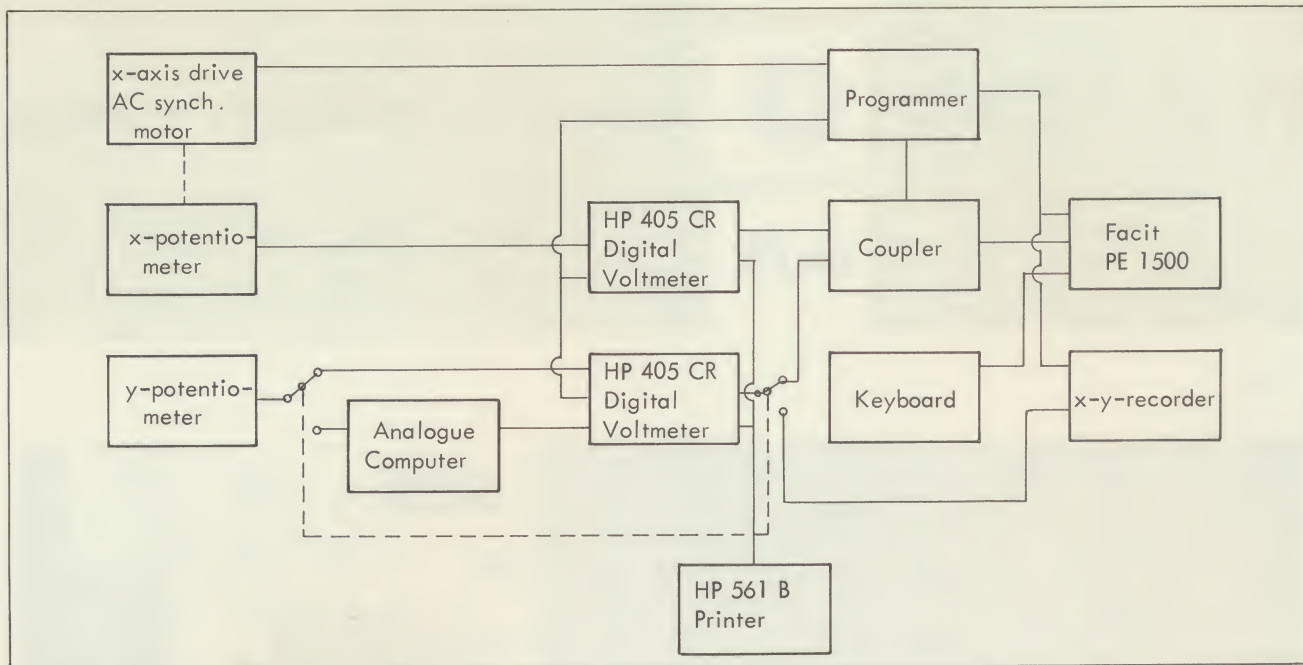
SEMI-AUTOMATIC DIGITAL EVALUATION OF OSCILLOGRAMS AND OTHER ANALOGUE RECORDINGS – INSTITUTE OF PHYSICS, UPPSALA UNIVERSITY, SWEDEN

Measurements of transient phenomena such as pulsed gas discharges are mainly reported on oscillograms. In order to obtain as much information as possible, processing of the initial data in a digital computer is highly desirable. To facilitate such processing equipment for transfer of oscillograph recordings to punched paper tape has been designed at the Uppsala University, Institute of Physics.

From left: Enlarger for projection of film on evaluation table. Below enlarger the slide for curve following in y-direction, mounted on its motor-driven carriage for motion in x-direction. On table at right keyboard for manual data entry on tape, behind keyboard paper tape punch. In rack from above: Digital voltmeters for x and y axis, read-out interval control unit, voltage supply for x and y potentiometers, x-axis drive control unit, digital printer and digital voltmeter – tape punch coupler.

The equipment accepts analog signals from an xy-recorder with a semi-automatic curve follower.

The signals are digitized with digital voltmeters and fed to a printer or a paper tape punch. A small analogue computer is included in the system in order to facilitate simple computations, such as integration of the input signals. A block diagram of the system is shown in fig-



ure. Except for the xy-recorder for transforming the curves on an oscillographic film into analogue form, all components are available commercially. The curve follower is coupled to potentiometers and is moved with constant velocity in the x-direction by a small synchronous motor, which also is used to give print commands at constant time intervals to the digital voltmeters and the punch, and in the y-direction by hand.

For a sine curve drawn on paper the tracking error is about 0.2 mm absolute, or less than 0.5 % of full scale deviation on typical oscillogram enlargments. For actual oscillograms the error may rise to about 1 % depending on trace quality etc.

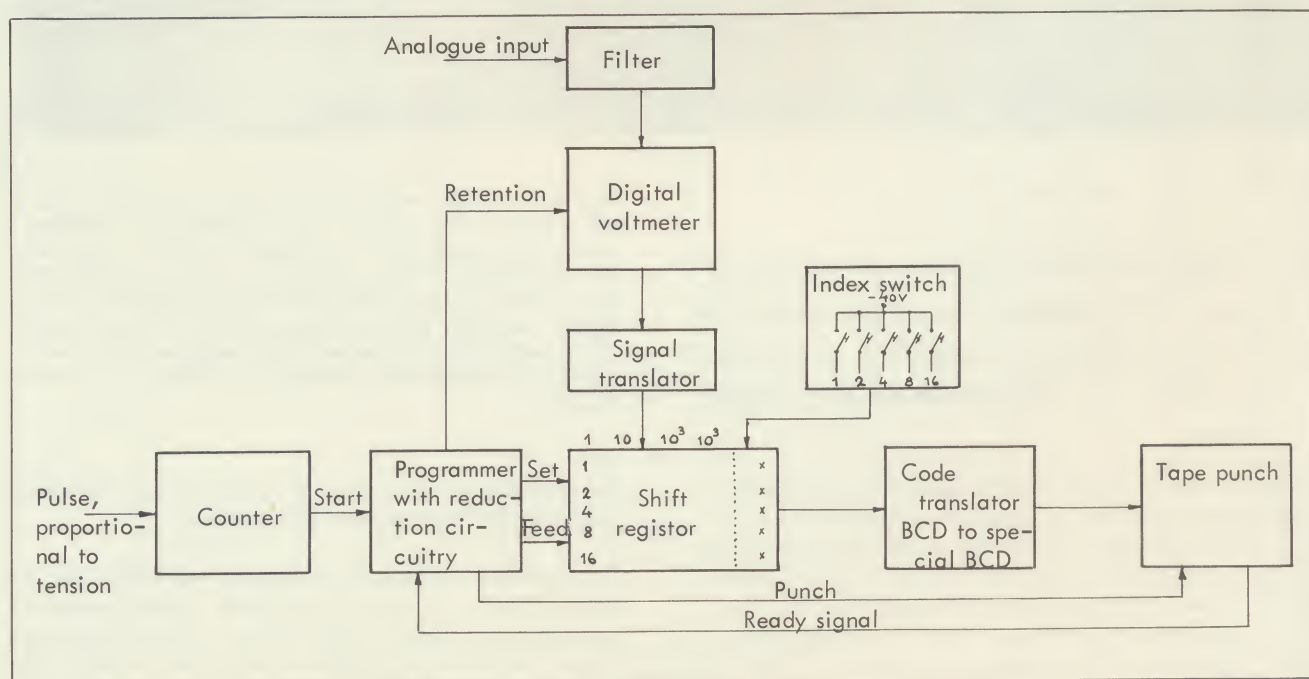
The men-minutes required for transfer of an oscillogram from film to digital computer input has been reduced from more than 50 men-minutes for manual read-out and punching, to about 3 men-minutes. At the same time the

overall accuracy is considerably improved by elimination of human reading and punching errors.

DATA LOGGING EQUIPMENT AT THE TECHNISCHE HOCHSCHULE, AACHEN

The LQ 302 data assembly circuitry enables tensile test results to be recorded on punched tape for subsequent evaluation by a Siemens 2002 digital computer. Analogue measurement values are obtained from an Instron device and are converted to digital values by a digital voltmeter. The signal is sent to the tape punch via a series-parallel translator. The tape punch records the measurement values and the corresponding index value.

Analogue signals emanating from an Instron bridge are smoothed in a filter and converted to digital values by a digital voltmeter with four numeral positions (200 measurements per second).



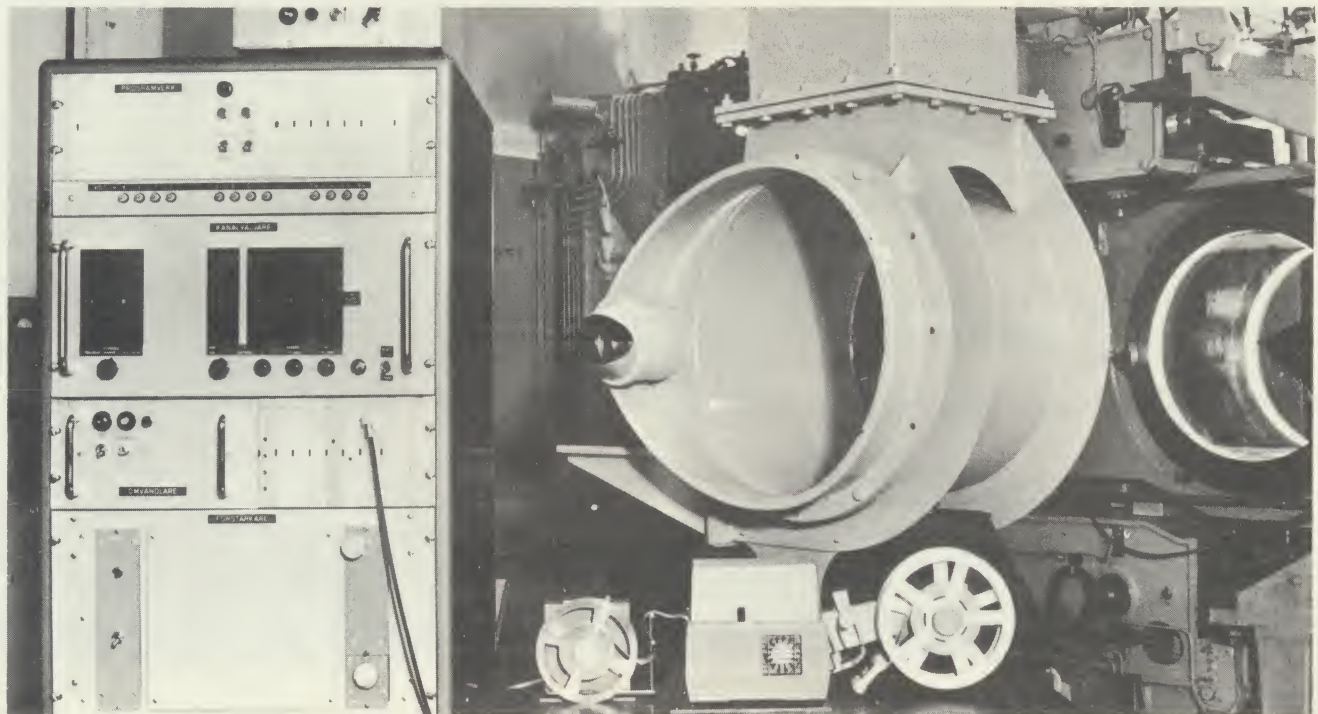
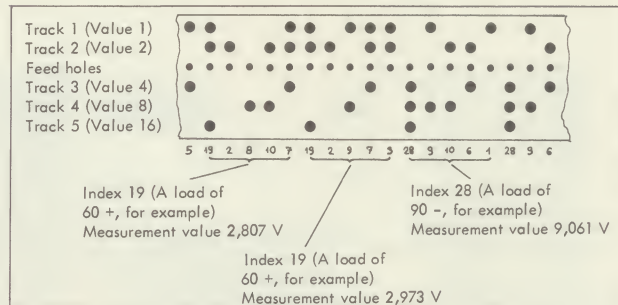
A single pulse or arbitrary number of pulses proportional to the measured tension is always needed to initiate recording. The pulses emanate from a device made by H. Wiener. The number of pulses $n_i = 1, 2, 4, 8, 10$ or 14 required to start recording can be selected with a switch (more extensive circuitry for a larger number of pulses is planned). The n th pulse functions as start signal for a delay flip-flop. It retains the measurement value indicated at that instant by the digital voltmeter (retention), and after 0.6 ms it gives the command "Set" which reads the binary-coded decimal measurement value into the shift register of the series-parallel translator. The command "Set" simultaneously introduces the index value (5 tracks, binary) in accordance with the position of the index switch.

The command "Set" also operates a flip-flop which starts the punching operation. Thus five characters are punched (4 measurement values and one index value) at the maximum speed which the Facit PE 1500 can develop (150 characters per second). The tape punch ready signal triggers feed and punching orders, etc., until the previous mentioned flip-flop is cut off after five punching operations by the feed pulse counter. The next recording operation is triggered by a new start pulse.

Numerals appear on the punched tape as binary-coded decimal digits with the exception of zero which is replaced by 10 (8 + 2). Eleven to thirty-one are reserved for index digits.

The data assembly circuitry operates at a speed of up to 25 measurement value recordings per second. The speed can be increased to 40 per second by increasing the number of recording tracks to 8 (two groups of four tracks). Circuitry design features ample provision for such an increase.

Sample of standard punched tape:



DATA LOGGING EQUIPMENT AT THE AERONAUTICAL RESEARCH INSTITUTE OF SWEDEN

One of the first data-logging equipments in Sweden was developed in 1960 by the Aeronautical Research Institute (A.R.I.) for measurements on aircraft models in wind tunnel tests and strength test of materials.

The transducers normally used in these measurements are strain-gauges and thermocouple elements. The number of measuring points varies from 5 to 56 and each measuring value is digitized to 3 digits.

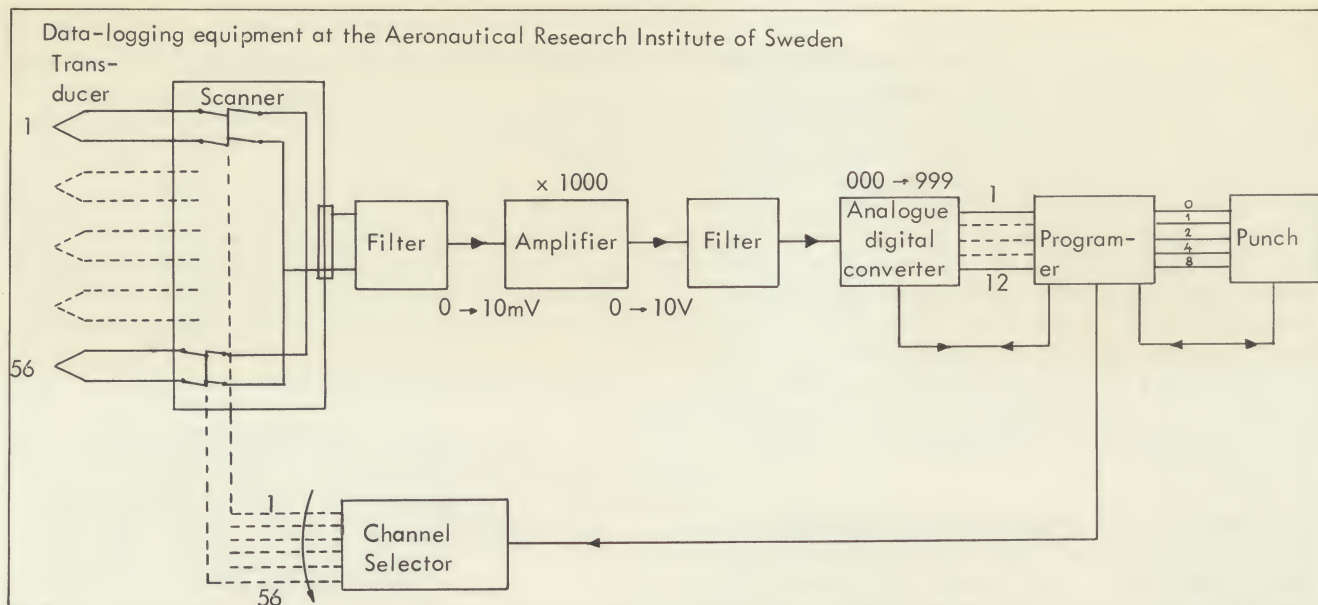
The block diagram shows the build-up of the system.

The maximum recommended scanning speed is 47 measuring points per second.

Most of the components are available commercially. Thus the digital converter is manufactured by SAAB, the amplifier by Offner and the punch by Facit. The scanner and channel selector, however, are designed and built by A.R.I.

The data obtained from the system is processed in an IBM 1620.

The experiences gained to date match up to expectancies, the costs for the system (approx. US \$20.000) are relatively low and the overall accuracy in measuring is about 0.1 %.



DATA LOGGING EQUIPMENT AT THE INSTITUTE FOR ATOMIC ENERGY IN HALDEN, NORWAY

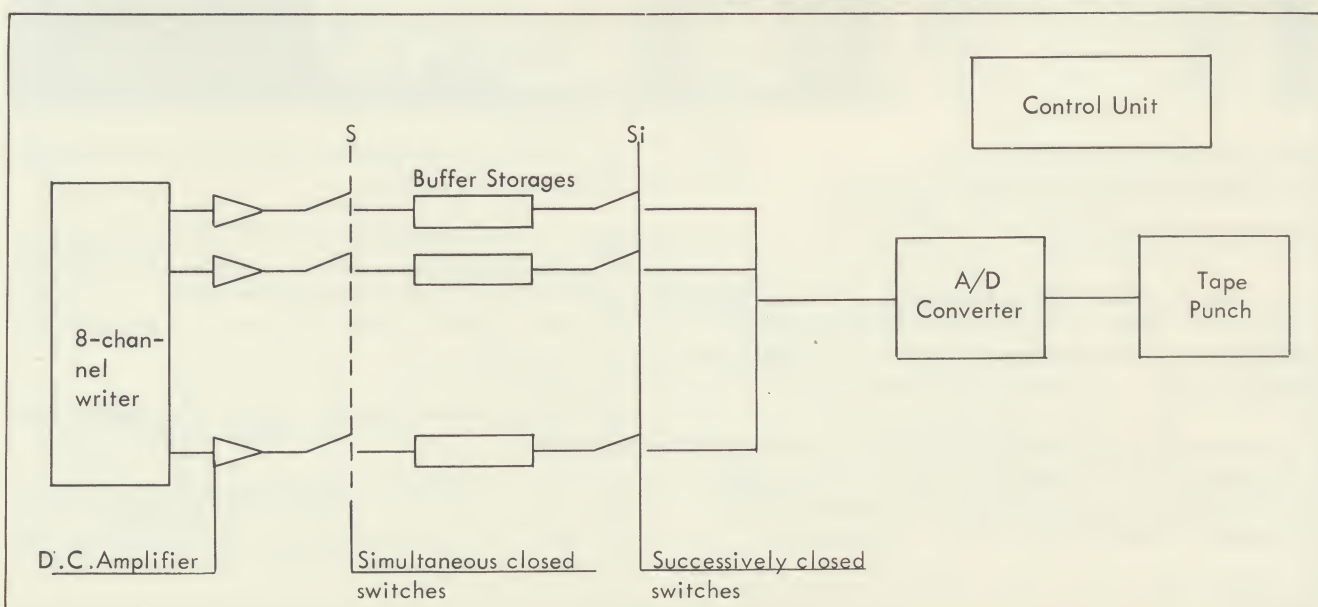
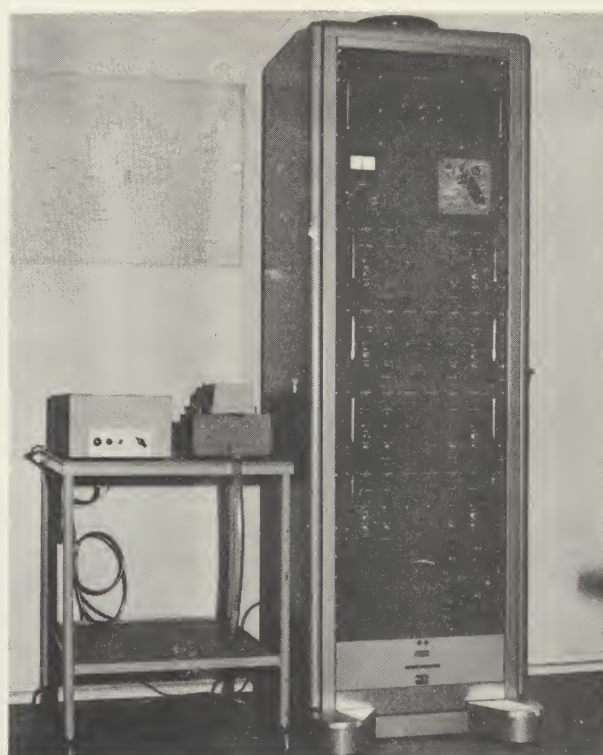
The Facit PE 1500 high-speed tape perforator is connected to an apparatus at the Institute for Atomic Energy in Halden, Norway, which is designed to record data from experimental work with nuclear reactions.

As can be seen, eight storage elements are fed simultaneously by eight tracks. The storage elements are connected in a predetermined sequence to the digitizer. The digital output is recorded on the paper tape by the punch, eight simultaneously sampled values being recorded as eight successive values on the tape.

The control unit is used to coordinate the program. For instance, if fewer than eight tracks are used, the sampling rate can be increased.

The digitizer is a Mullard L 281. It has a sampling rate of up to 1 kc.

The tape produced in this manner is then put through a data processing machine. The data are used for a large number of calculations, such as auto-correlation and cross-correlation.

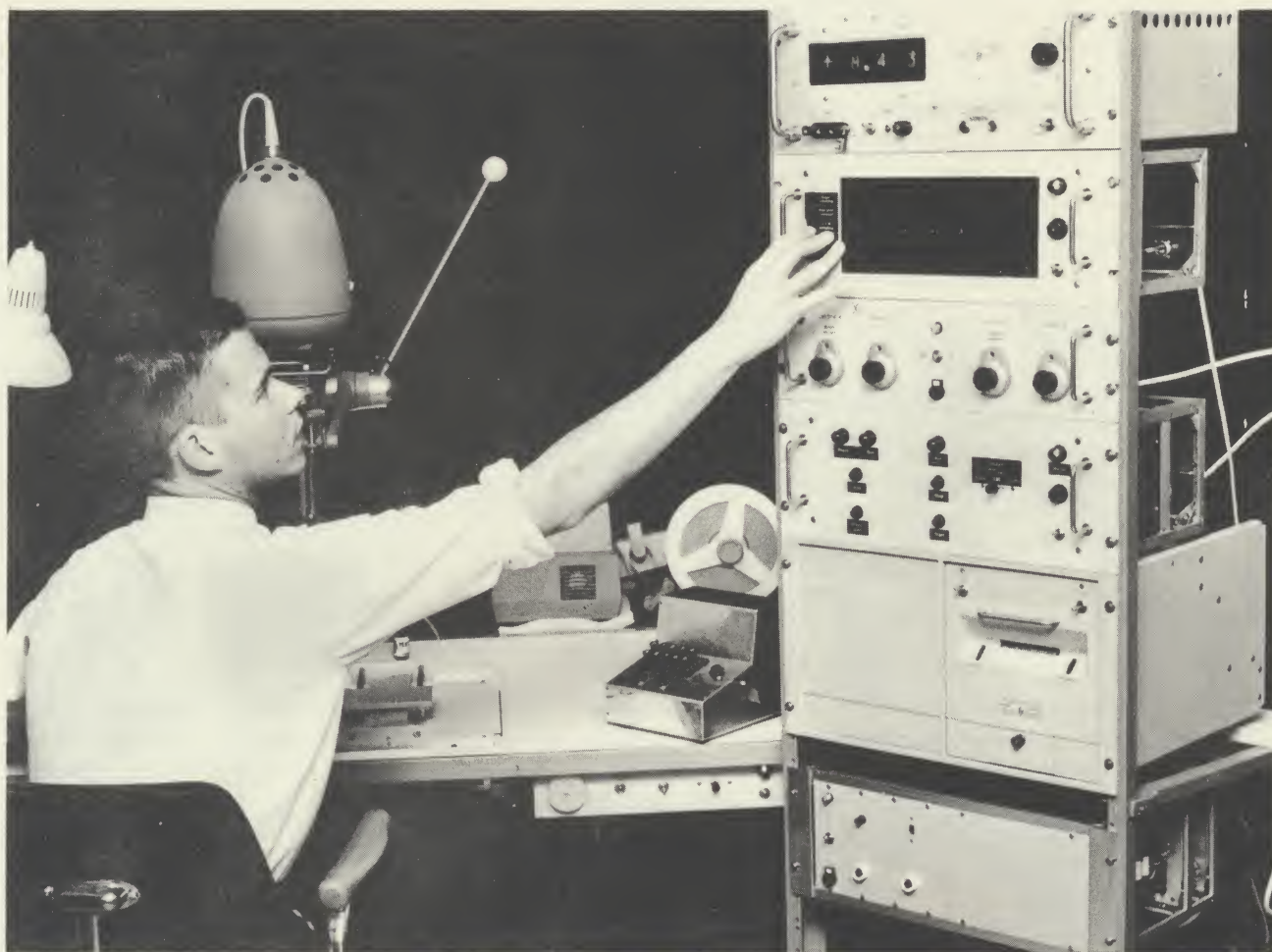


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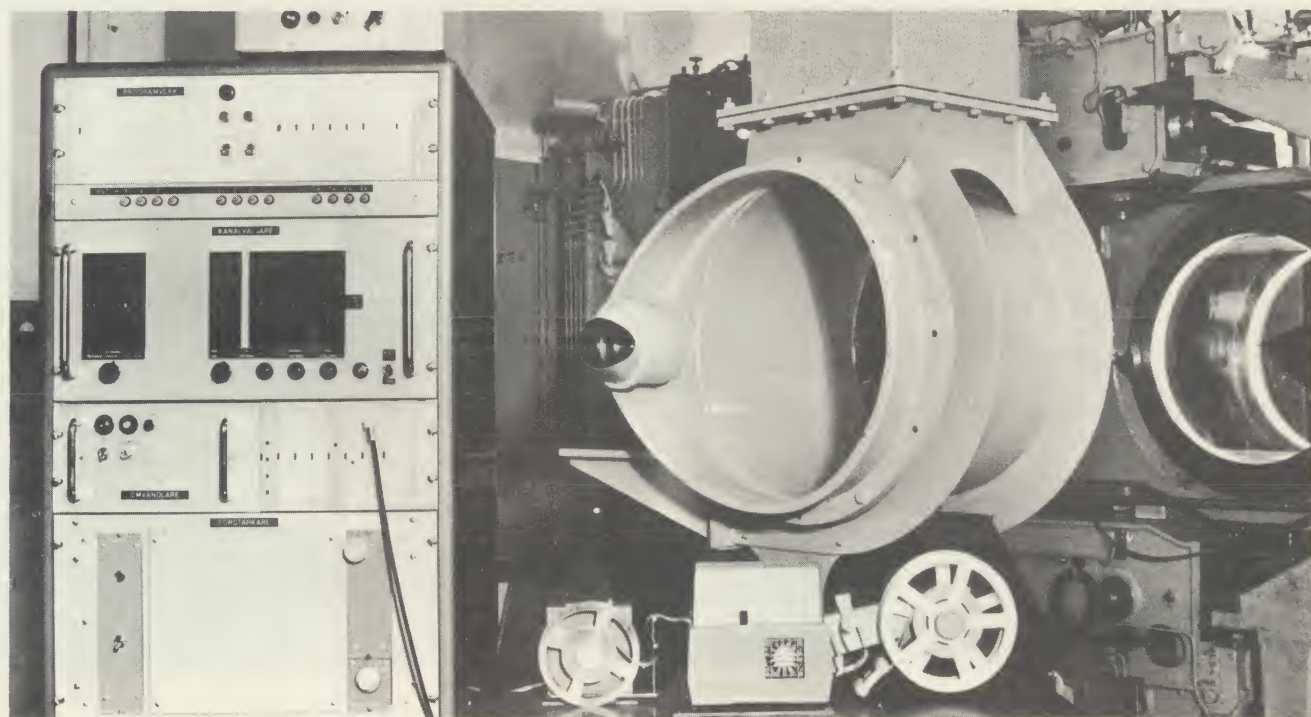
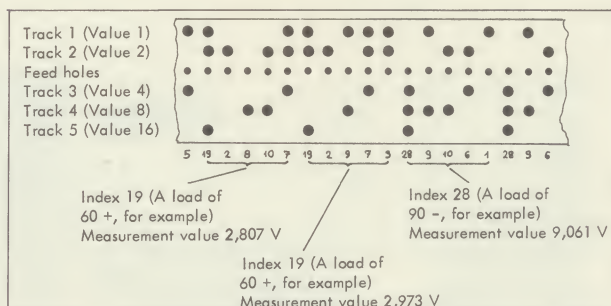
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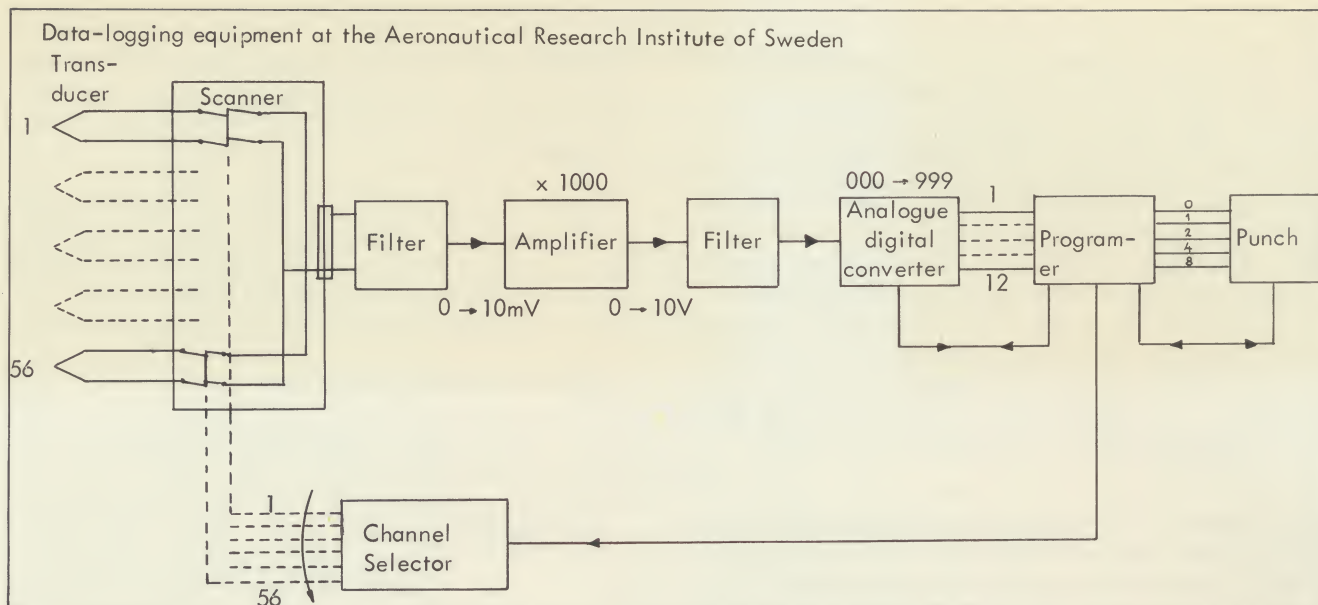
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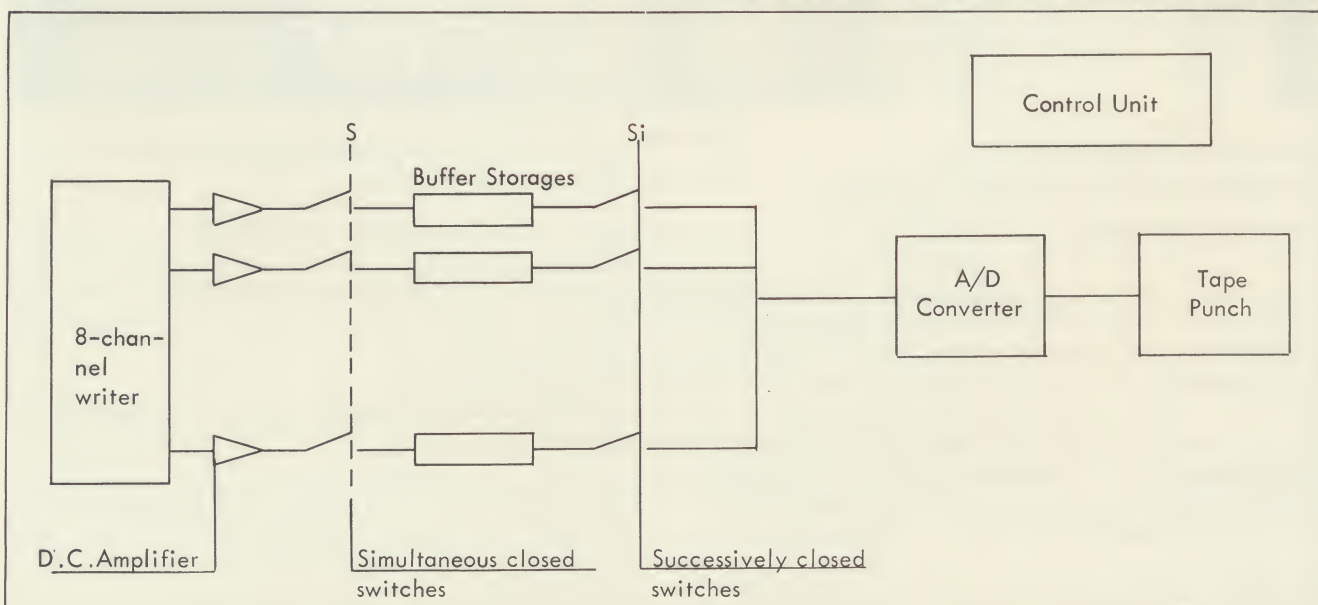
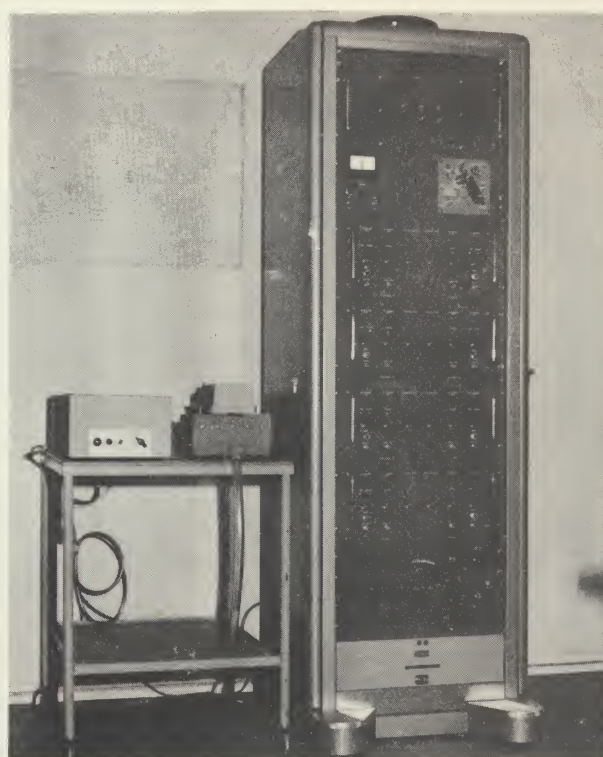
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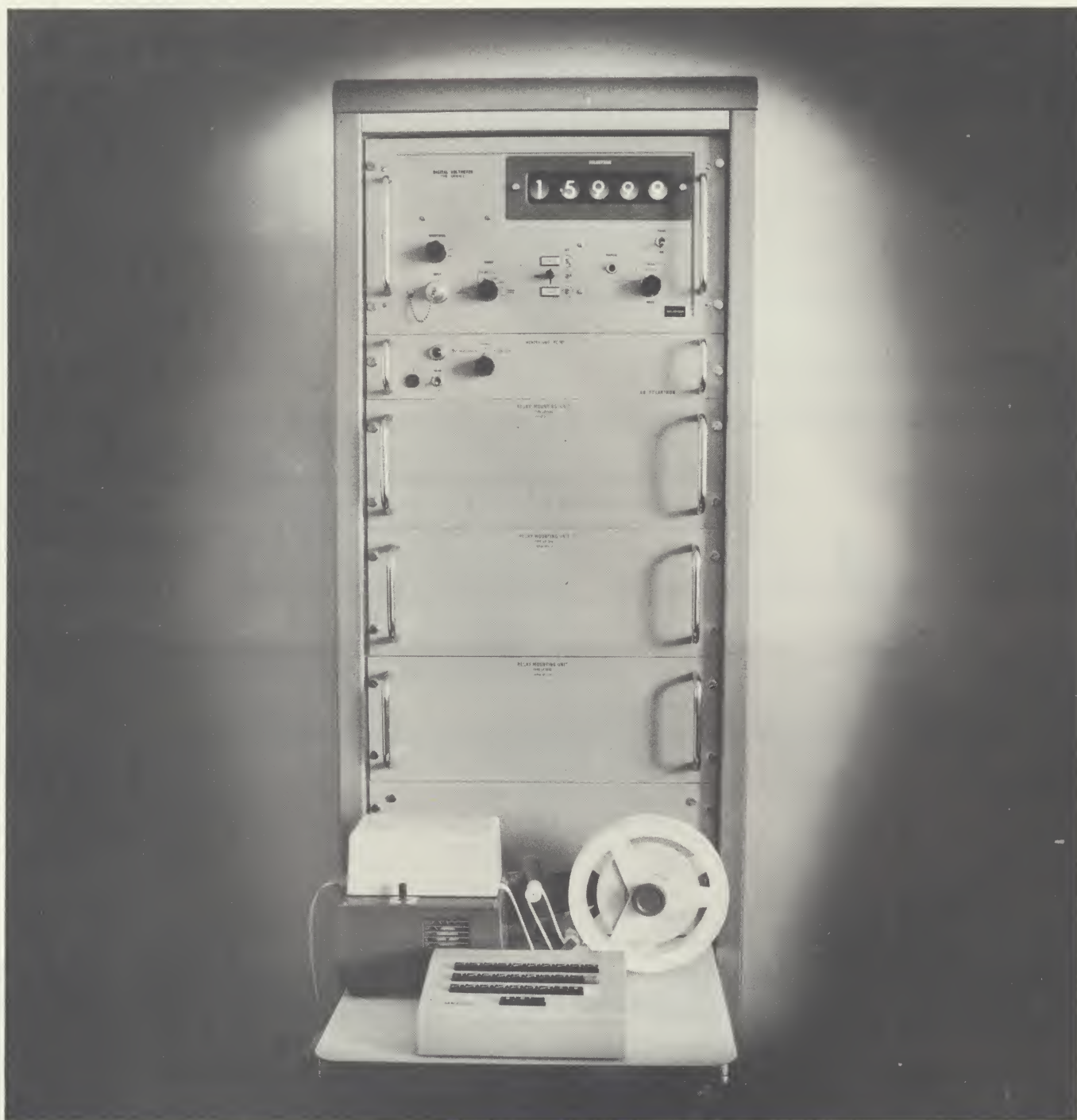




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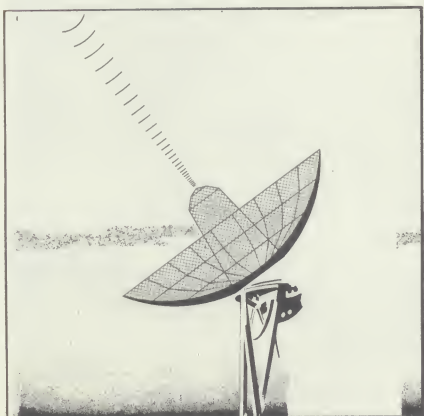
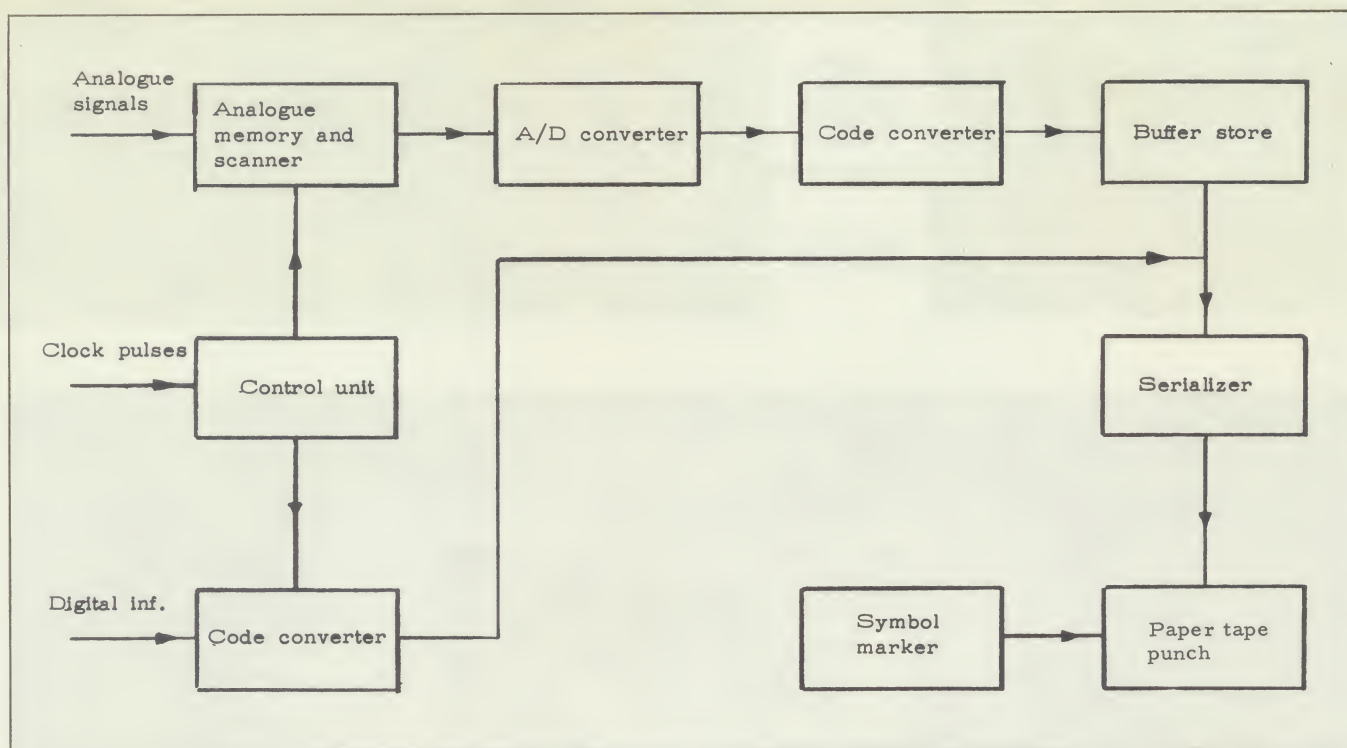
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**Data logging equipment
at Råö observatory in Sweden**

For automatic recording of data concerning the transmission of information via telesatellites an equipment has been installed at Råö observatory for radio physics.



The input information is among other things antenna angles, time in hours, minutes and seconds, voltages analogue to noise contents, signal level, doppler effect etc. The equipment is capable of recording 15 channels of information every second. The reading of the different channels will take place simultaneously ± 1 ms. The number of characters per channel is 6, recorded in international Telex code. The block diagram shows the build-up of the system.

The system receives a clock pulse with a repetition rate of one per second. This clock pulse initiates hold function for both analogue and digital input information and starts the recording. The recording continues until all the required channels have been scanned after which the system waits for the next starting pulse.

The system consists of a standard Solartron digital voltmeter with a maximum resolution of $10 \mu V$, a punch encoder also made by The Solartron Electronic Group Ltd. in England and a paper tape punch Facit PE 1500. All the remaining units and the system itself are made by Schlumberger Svenska AB in Sweden.

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